Curriculum Vitae

Prof. Peter Bösiger

Professor of Biomedical Engineering
Head of Biomedical Engineering Laboratory
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Professional Career

since 2003	Full Professor of UZH and ETH Zurich; Director of the Institute for Biomedical Engineering
2003	Co-Foundation of the Spin-Off company Gyrotools GmbH
since 2001	Chairman of the Center for MRI of UZH and ETHZ
1997	Initiation of the International Zurich Magnetic Resonance Education Center
1993–2003	«Permanent Guest Professor» at ETHZ
since 1991	Professor of Biomedical Engineering at the UZH, Chairman of the Division Biophysics of IBTZ
1985–1991	Head of the MRI/MRS research division
1985	Habilitation at the Medical Faculty of the UZH
1984–1985	Research fellowship at Philips Medical Systems in Best NL, at the Philips Research Laboratories in Hamburg, and at Emory University in Atlanta GA
1979–1991	Senior Research Associate at the Institute of Biomedical Engineering (IBTZ) of the University of Zurich and of the Swiss Federal Institute of Technology (ETHZ)
1977–1979	Research Associate at the Institute of Physics of the UZH
1973–1977	Dr. phil. nat. sc. (principal advisor: Prof. Dr. E. Brun) at the UZH, Award of the Faculty
1973	Diploma in Experimental Physics (principal advisor: Prof. Dr. E. Brun) at the UZH

Publications and Patents

- 330 original scientific publications in international reviewed scientific journals; 9200 citations
- 30 scientific or technical patents (author or co-author)
- Author of the book «Kernspin-Tomographie für die medizinische Diagnostik», B. G. Teubner, 1985

Honors

- Award of the Faculty of Natural Sciences of the University of Zurich (1977)
- Award of Georg Friedrich Götz, University of Zurich (1988)
- Thermology Commendation Award, American Academy of Thermology (1989)
- Günther-Laukien-Award (1993)
- Fellow of the International Society for Magnetic Resonance in Medicine (2010)

Teaching

- Lectures on Biomedical Engineering, Biomechanics, and Magnetic Resonance in Medicine
- Practical studies in Biomedical Engineering and Medical Physics
- Seminars in Biomedical Engineering, Magnetic Resonance Imaging and In Vivo Spectroscopy, Cardiology and Heart Surgery, Neurological, Neuroradiological, and Nuclear Medicine for Functional Imaging, Stochastic Case Examples for Engineers
- International Zurich Magnetic Resonance Educational Courses

Memberships and Board Memberships

- International Society for Magnetic Resonance in Medicine (former board member)
- European Society of Engineering and Medicine (former executive board member)
- European Society of Magnetic Resonance in Medicine and Biology
- Society for Cardiovascular Magnetic Resonance
- Cardiovascular System Dynamics Society
- Swiss Society of Biomedical Engineering (SSBE; former president)
- German Society of Biomedical Enginering
- Swiss Society of Radiation Biology and Medical Physics
- Swiss Association of Neuroradiology
- Zurich Physical Society
- International Federation for Medical and Biological Engineering
- Swiss Academy of Technical Sciences (representative of SGBT)

Editor and Editorial Boards

- Biomedical Engineering (Co-Editor)
- Magnetic Resonance in Medicine (Editorial Board)
- Acta Neurologica Scandinavica (Editorial Board)
- Computerized Medical Imaging and Graphics (Co-Editor)
- Kardiovaskuläre Medizin (Editorial Board)

Boards of Reviewers

- Circulation
- Journal of Magnetic Resonance Imaging (JMRI)
- Journal of Magnetic Resonance
- MAGMA
- Annals of Biomedical Engineering
- Journal of Biomedical Engineering
- Technology and Health Care

Personnel

Scientific coworkers	20
Non-scient. coworkers	5
Diploma/BA/MS projects	10
Doctoral students	16

For more information visit www.biomed.ee.ethz.ch

Prof. Peter Bösiger - Research Highlights

Bioimaging

Keywords

- Magnetic Resonance Imaging
- Magnetic Resonance Spectroscopy

Future priority areas

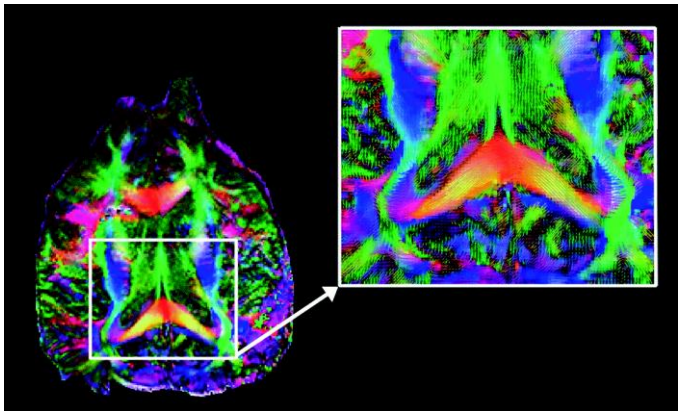
Assessment of human organ function by magnetic resonance (brain, heart, digestive tract)

Focus

Ongoing research is dedicated to the exploitation of the significant gains of high field MRI with field strength of 3 Tesla and more. The new magnet with field strength of 7 Tesla opens up new opportunities and challenges by increasing the sensitivity of MRI for the assessment of the brain anatomy as well as the brain function. New techniques have to be developed, which are based on the ideas of parallel imaging and field mapping and sensing.

Functional Magnetic Resonance Imaging of the Human Brain

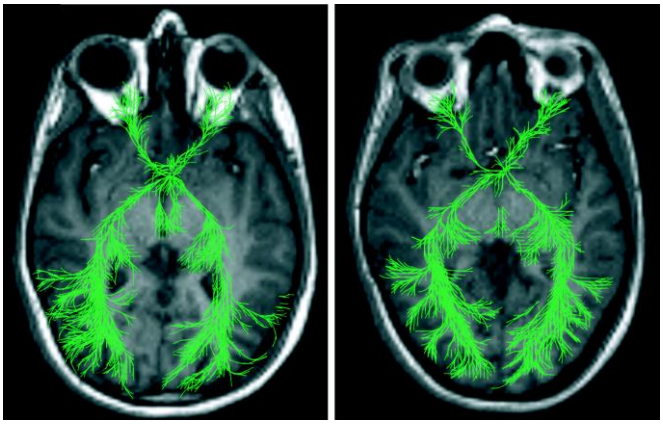
Owing to its high soft tissue contrast, and the advantage that no ionizing radiation is involved, MRI has become the premier modality in today's radiological practice for visualizing anatomy and anatomical changes caused by diseases. Despite its vast potential, MRI is traditionally hampered by both low sensitivity and long acquisition time. During the last years, however, significant contributions have been made to overcome these problems. The first breakthrough is the invention of high-field MRI magnets, which are presently entering the research community. These high-field MRI systems make an improved signal-to-noise ratio possible, thus partially overcoming the sensitivity problem. The second breakthrough is the development of advanced radiofrequency and imaging technology, which allows for a shorter acquisition time, for a better spatial and temporal resolution, for a reduction of artifacts, and for an improvement of the patient comfort during the examination.
With the introduction of these new and powerful procedures, MRI offers a unique potential for the assessment of both anatomical structures and various kinds of organ functions. The information gained from functional MRI examinations does not only entail more reliable diagnosis and therapy planning, but it also contributes towards a deeper understanding of basic physiology and its changes owing to aging and diseases.



Diffusion tensor image of a human brain area. The colors indicate the direction of the first eigenvector of the diffusion tensor (C. Reischauer, H. Mandelkow, IBT; Philips Medical Systems, Cleveland, USA).

The Investigation of Brain Connectivity, Plasticity ...

Blood oxygenation level dependent (BOLD) functional Magnetic Resonance Imaging (BOLD-fMRI) of the human brain provides information on the spatial location of functionally active cortical areas. Complementary information on brain «wiring» can be gained from images visualizing the diffusion of water in the brain tissue and, thus, indicating the courses of brain fiber structures (diffusion tensor imaging; DTI). The combination of fMRI, DTI techniques and brain fiber tracking allows for an extensive study as well as an improved understanding of the connectivity and the reorganization of brain functions, i.e. plasticity, after functional disorders in neuroscientific research.
Newly developed diffusion tensor imaging (DTI) techniques enable the non-invasive study of white matter structure of the human brain in vivo. By measuring the self-diffusion of water in the tissue in three dimensions, the main diffusion direction is estimated from the eigenvectors of the 3D tensor ellipsoids. Since the diffusion of water in brain matter is restricted by the intracellular axonal space and by the interstitial, extracellular space among the axons, the fiber pathways and their underlying network can be reconstructed, using so-called fiber tracking algorithms. The restrictions of both techniques are imposed by the low signal-to-noise ratio of the MRI data, which asks for highly elaborate statistical methods to extract the relevant information.



Diffusion tensor MRI:
Reconstruction of the nerve fibers of the visual tract of two subjects (P. Stämpfli, Doctoral Thesis ETHZ, 2007)

...and Metabolism

Localized Magnetic Resonance Spectroscopy (MRS) reveals neurochemical compounds in vivo and therefore enables us to investigate the biochemical or metabolic processes in the healthy as well as in the diseased brain. The possibility of assessing metabolites, which play a key role in neurotransmission such as y-aminobutyric acid (GABA) as well as in neurodegeneration such as glutathione (GSH), also raises interest in MR spectroscopy for the investigation of psychiatric diseases.

For more information on our research group and our projects:
www.biomed.ee.ethz.ch/
www.mr.ethz.ch/
www.master-biomed.ethz.ch